USKH

SHARED VISION. UNIFIED APPROACH.

September 30, 2008

Gary J. Gaffney, P.E.
Idaho Department of Environmental Quality
2110 Ironwood Parkway
Coeur d'Alene, ID 83814

Subject: Addendum 2, Design Report for Wastewater Treatment Facilities, City of Plummer

Dear Mr. Gaffney:

Based on our meeting earlier today, there are three issues for which you require clarification before you are able to approve the Design Report for the Wastewater Treatment Facilities for the City of Plummer. Those issues are:

1. Address Potential Groundwater Impacts of the selected discharge, referred to in the design report as Alternative B.
2. Address biosolids handling odor control measures
3. Compliance with IDAPA 58.01.16.450.01(c) regarding setback from residential areas.

We've addressed these concerns as follows. The revised pages are attached to this letter and are referenced in each response.

1. We have re-reviewed the geotechnical report for the area of the Alternative B discharge. The report characterized the permeability of the clayey layer underlying the site at approximately 2.6 x 10^{-4} cm/sec. This is not sufficient for characterization as an impermeable layer. Therefore, our specification will include addition of a clay admixture to the underlying clay layer to decrease permeability to 1 x 10^{-6} cm/sec or less across the entire 10-foot wide discharge bed. This will prevent impact to even the shallow unconfined groundwater underlying the discharge, which does not have domestic water well withdrawals, and further protect the deeper municipal wells withdrawing from the Wanapum aquifer. A discussion has been added to Section 8 of the design report.
2. To further control odors at the site, biosolids handling will include the use of a dedicated trailer located under the de-watered biosolids auger. This area will be enclosed for odor control. Once full, the lined trailer will be towed to the land application area and dumped on a stock pile. The land application area is already fenced with barb-wire-topped 6-foot high chain link. Signs will be added warning of the presence of biosolids storage and application. The stockpile will be located in a corner of the site well away from the one existing residence on

Toetly road, and far from potential residential sites. A discussion of this has been added to Section 9 of the design report.

3. To comply with IDAPA 58.01.16.450.01(c), the clarifiers, aeration basins, and aerobic digesters will be covered to prevent transmission of odors. Flexible membrane and aluminum or FRP rigid covers are under consideration. The selected cover will be the least cost alternative providing prevention of aerosol-borne odors and ready access to aerators and other equipment. The potential for obtaining easements was explored with the City and considered unfeasible due to time and cost. Re-siting the plant further to the north is also not feasible because of timing and the additional costs that would be incurred from the earthwork necessary to accommodate the plant and the larger influent lift station necessary to provide flow to the plant from the collection system. Conventional roofing was also considered but rejected because of the unbudgeted cost. A discussion of the addition of the cover has been added to Section 6 c.

We look forward to seeing your letter approving the Design Report for Wastewater Treatment Facilities for the City of Plummer in the very near future.

Sincerely,
USKH Inc.

Alan E. Gay, P.E., Associate
Project Manager

Attachments: Design Report for Wastewater Treatment Facilities for the City of Plummer, Rev. 2, Sept. 2008

c: Donna Spier, City of Plummer, P.O. Box B, Plummer, ID 83851
Jim Kackman, Public Works Director, Coeur d'Alene Tribe, P.O. Box 408, Plummer, ID 83851
Scott Fields, Water Quality Program Director, Coeur d'Alene Tribe, P.O. Box 408, Plummer, ID 83851
Susan Poulsom, EPA Region 10, 1200 Sixth Avenue, Seattle, WA 98101

City of Plummer Wastewater Treatment Facility Design Report
Table of Contents

Tables:

Exhibits:

Appendices:

1. Introduction

The City of Plummer, Idaho, has applied for and received an ICDBG grant to fund design and partially fund construction of a new municipal wastewater treatment facility. The balance of the project funding hinges on congressional override of a promised Presidential veto of the 2008 Farm Bill. This appears likely, as the bill passed both houses of Congress with greater than two-thirds majorities.

The City is located in Northern Idaho, within the Coeur d'Alene Indian Reservation, and is administered from City Hall, with a mailing address of City of Plummer, P.O. Box B, Plummer, Idaho, 83851. The current Mayor is (May 2008) Tim Clark, reachable at City Hall at (208) 686-1641.

The proposed project is necessary because the existing lagoon-based wastewater treatment facility is too small to adequately treat existing and projected influent flows, and is not designed to achieve very low phosphorus concentrations in its discharge. Such low phosphorus concentrations are in the proposed 2010 NPDES permit. In addition, the existing facility lies on leased ground. Existing permits require holding back discharges for at least two (separate) months each year. All of these items are to be mitigated by the proposed new wastewater treatment facilities.

This pre-design report is completed in compliance with the accepted water quality management policy regarding Plummer Creek adopted by the Idaho Department of Environmental Quality (IDEQ), the EPA and the Coeur d'Alene Tribe. An Environmental Report is scheduled for publication in the summer of 2008, and the comment period for the Report will run concurrently with IDEQ and funding agency review of the preliminary plans and specifications.

1.1 Report Preparation Criteria

This report has been prepared in accordance with the guidelines for preliminary engineering reports included in IDAPA 58.01.16.

During preparation of this document, an agreement was reached with the Coeur d'Alene Tribe to allow discharge to an artificial wetland above Plummer Creek. Among the criteria for acceptance of this discharge is the requirement for Class A reuse water quality. IDAPA 58.01.17.601 includes the following requirements for this report: "The engineering report shall include, but not be limited to, the following items as applicable: purpose; approach; development of alternatives; technical, financial, managerial, and legal issues; emergency response and security; operation and maintenance; consideration of alternatives for disposal of unanticipated excess effluent that does not meet Class specifications; pilot testing; client use issues; potential markets for reclaimed wastewater;

potential sources of wastewater; public involvement and perception; targeted markets for reclaimed wastewater; allocation of reclaimed wastewater; preliminary investigations; staff development; treatment system upgrades to meet Class A requirements; distribution system development and schedule; new development infrastructure; reservoir or booster capacity; water balance calculations; costs; applicable regulations; and potential funding sources. This engineering report shall be stamped, dated and signed in accordance with Idaho Board of Registration of Professional Engineers and Professional Land Surveyors, IDAPA 10.01.02, 'Rules of Professional Responsibility.'" These elements have been incorporated into this design report.

2. Project Description

The proposed project will address the treatment and disposal of Plummer's wastewater in accordance with Federal, State, Tribal and Local guidelines. The selected treatment alternative, from the November 2007 Engineering Report for Wastewater Facilities (ERWF) will be constructed in two phases, with design modifications. See Appendix VII for the ERWF.

The ERWF specified that Phase I involve an extensive overhaul/retrofit of the existing primary lagoon in order to provide effluent storage to prevent periodic flow into Plummer Creek when the Creek flow is too low to allow mixing. The existing primary lagoon would provide approximately 20 million gallons of storage in order to accommodate a month of effluent expected as a result of the treatment plant full build out. Due to lack of available land surrounding the lagoon, the lagoon would be expanded vertically rather than horizontally. In order to do this, all existing biosolids would first be removed from the lagoon and then the lagoon would be re-graded. Once the expanded capacity is reached, the lagoon would be lined with an impermeable geomembrane. At this stage, it would be ready for effluent storage. The remaining existing treatment facilities would be demolished and the land reclaimed by the City. However, as noted above, the facility will now be allowed to have a year-round discharge to an artificial wetland above Plummer Creek. The remainder of this report is built around the year-round discharge.

Phase I of the City's treatment facility upgrade will include a base package mechanical biological treatment plant capable of initially treating the current flows, sludge dewatering equipment and storage, additional phosphorus removal and UV disinfection. Phase II will involve the expansion of the mechanical biological treatment plant which will be used in parallel with the Phase I plant and will double the treatment capacity, accommodating projected increases in wastewater flows. The objective of this method of treatment and disposal is to meet the Plummer Creek effluent quality standards listed in Table 4-2 of this report through pretreatment screening, biological processing, clarification and disinfection prior to effluent disposal. Diverging from the ERWF, the additional phosphorus removal, originally slated to be constructed in the last phase of the project will be included during Phase I construction. This is due to the chosen method of disposal. Please refer to Section 8 for further effluent disposal discussion.

From the ERWF, the phase one estimated present value cost for the chosen alternative in 2007 was $11,152,935 ($16,183,500 for build out) based on previous opinions of probable cost for similar facilities, an inflation rate of 4%, a 20% contingency, and engineering costs totaling 20% of construction costs. This present value cost includes the additional cost of a Class II operator, since the City currently does not have an operator with this classification. It also includes the cost of anticipated tests and routine maintenance. The Phase I estimated construction cost from the ERWF is $6,981,016. However, due to modifications of the selected alternative construction and O&M costs have changed. Please see Section 12 for an updated project cost estimate.

See Section 5.1 Design Considerations for a discussion on the two types of mechanical biological treatment plants considered for this project.

3. Quantity & Quality of Wastewater

According to the ERWF, the 2007 average daily (dry) flow was 156,500 gallons per day (gpd). However, the peak average monthly flow recorded between 2005 and 2007 was 466,000 gpd, which will better serve as a guide to sizing the facilities. Using the available flow data, a Phase I average design flow rate of 315,000 gpd is proportional to the projected growth described in the ERWF, and a daily peaking factor of 2.0 is appropriate for an extended aeration biological treatment system. This results in a peak day hydraulic capacity requirement of approximately 0.63 million gallons per day for the first phase of new facility. This peaking factor is supported by design data supplied by AeroMod, located in Appendix D of this report. Phase II of the treatment plant will expand the treatment capacity to allow average flows of 0.6 million gallons per day with a peak flows of 1.2 million gallons per day. Unless otherwise noted, the design flow rate for this report is 219 gpm. Table 3-1 shows peak recorded monthly flows from 2005 through 2007.

Table 3-1
2005 – 2007 Recorded Monthly Flows to Wastewater Treatment Facility

Month	Year	Average Flow (mgd)*	Peak Day Flow (mgd)
January	2005	0.229	0.343
February	2005	0.220	0.252
March	2005	0.236	0.368
April	2005	0.296	0.368
May	2005	0.258	0.374
June	2005	0.231	0.273
July	2005	0.221	0.245
August	2005	0.243	0.283
September	2005	0.221	0.313
October	2005	0.171	0.272
November	2005	0.198	0.268
December	2005	0.215	0.407
January	2006	0.270	0.382

Month	Year	Average Flow (mgd)*	Peak Day Flow (mgd)
February	2006	0.222	0.353
March	2006	0.304	0.466
April	2006	0.301	0.450
May	2006	0.177	0.295
June	2006	0.203	0.293
July	2006	0.159	0.211
August	2006	0.127	0.171
September	2006	0.131	0.148
October	2006	0.170	0.218
November	2006	0.248	0.306
December	2006	0.245	0.374
January	2007	0.340**	0.430**
February	2007	0.303**	0.416**
March	2007	0.306**	0.400**
April	2007	0.215	0.397
May	2007	0.155	0.270
June	2007	0.163	0.246
Overall Peaks		**0.226**	**0.466**

* ERWF Table 3-2

** Plummer Creek flooded into a broken section of the collection pipe, temporarily increasing flows to the facility.

The expected water quality for the influent flow is also included in the ERWF. The following Table 3-2 shows the same information. The values in Table 3-2 are the average recorded and calculated values for common wastewater parameters. As is indicated in the water quality data, there are no outstanding industrial wastes or other sources of high-concentration pollutants present or expected in the sewer system.

Table 3-2
1993 and 2001 Wastewater Analysis Results

Parameter		1993 Average	2001-2002	2001 Peak	2005 Peak
BOD	In	71 mg/L	157 mg/L	337 mg/L	180 mg/L
	Out	11 mg/L	11 mg/L	20 mg/L	23 mg/L
TSS	In	119 mg/L,	156 mg/L	367 mg/L	340 mg/L
	Out	17 mg/L	14 mg/L	30 mg/L	25 mg/L
Fecal colif.	In	No test	No test	No test	No test
	Out	79#/100 mL	8#/100 mL	300#/100 mL	300#/100 mL
Avg. Flow		0.101 mgd	0.097 mgd	0.840 mgd	0.840 mgd

* ERWF Table 4-1

4. Degree of Treatment Required

Since the treated wastewater is to be primarily disposed of by seasonal discharge into Plummer Creek, the effluent must meet the limitations set forth by the 2005 National Pollutant Discharge Elimination System (NPDES) Permit Effluent Standards. Table 4-1 shows the applicable limitations.

Table 4-1
2005 NPDES Permit Effluent Limitations

Parameter	Average Monthly	Average Weekly
BOD	30 mg/L, 85% removal, 33 lb/day	45 mg/L, 85% removal, 49 lb/day
TSS	30 mg/L, 85% removal, 33 lb/day	45 mg/L, 85% removal, 49 lb/day
Fecal Coliform	126#/100 mL	200#/100 mL
Flow	0.130 mgd	0.200 mgd
	No discharge from May 1 to November 30	
pH	Daily minimum >=6.5, Daily maximum <=9	

* ERWF Table 4-2

Recent discussions with the Coeur d'Alene Tribe have addressed the possibility of stricter permit limits for treated effluent discharge to Plummer Creek. It is expected that these additional water quality restrictions will become effective in August 2010. Table 4-2 identifies the tighter effluent limitations for discharge to Plummer Creek.

Among the Coeur d'Alene Tribe's acceptance criteria for the proposed discharge to an artificial wetland above Plummer Creek is that it be treated to Class A reuse standards. Pursuant to that requirement, the table below was developed:

Table 4-2
Proposed 2010 NPDES Permit Effluent Limitations, Discharge to Plummer Creek

Parameter	Average Monthly	Average Weekly
BOD	10 mg/L, 90% removal, 27 lb/day	10 mg/L, 90% removal, 40 lb/day
TSS	5 mg/L, 95% removal, 14 lb/day	10 mg/L, 90% removal, 40 lb/day
Turbidity	2 NTU**	5 NTU***
Fecal Coliform	2.2#/100 mL	---
TP	0.025 mg/L	0.05 mg/L
TN****	1.5 mg/L	2.5 mg/L
Flow	0.475 mgd Peak Daily, 0.315 mgd Average Monthly	

pH	Daily minimum >=6.5, Daily maximum <=9

*Adapted from ERWF Table 4-5, and modified for Class A reuse standards
** NTU = nephelometric turbidity units
*** Instantaneous peak limit
**** Total N as Ammonia

The February 2008 Environmental Report prepared by USKH states that the project is not located within a groundwater protection zone and that no Total Maximum Daily Load has been established for Plummer Creek. Regarding the proposed upstream discharge site the report states, "...although shallow groundwater exists, the clay content, gentle slope and ponding effect of the soils in conjunction with the effluent limits and monitoring requirements outlined in the 2005 NPDES permit will adequately protect the receiving waters."

5. Proposed Treatment

The treatment alternatives that were discussed in the ERWF include:

1. **Lagoon-based extended aeration plant.** This alternative was considered because of the perceived lower cost of construction compared to a packaged plant; however, the cost of the lagoon modification, individual components plus installation actually make this alternative more expensive than a package plant with present economics, and therefore also more expensive than the selected alternative.

2. **Mechanical biological treatment plant with discharge to Plummer Creek and land application** was considered to be the selected alternative in the ERWF. Please see the discussion in Section 5.1 for the treatment plant selection. Additionally, see Section 8 for a discussion on the effluent disposal methods.

3. **Total containment** was considered as an alternative, since there would be very low operational cost and a very simple construction process. However, the cost of constructing an impoundment large enough to allow evaporation to outstrip precipitation plus average annual influent flow rendered this alternative economically unfeasible.

4. **Mechanical biological treatment plant with subsurface disposal.** This alternative was considered because groundwater quality discharge requirements could be met without a full scale retrofit of the existing lagoons, alum addition or disinfection, thereby avoiding capital costs associated with other alternatives. However, the material and construction costs for a leachate return system and a 107 acre disposal field containing 1.5 million lineal feet of small-diameter dripline were found to be greater for this alternative than for the selected alternative.

5. **Mechanical biological treatment with continuous discharge to cascading overland flow/wetland.** This alternative was attractive because it combined the advantages of a packaged mechanical wastewater treatment facility with high-loading, low- maintenance and year-round discharge to an overland flow wetland area. However, in order to hydraulically accommodate the existing annual peak month flow, an additional 154 acres would have to be purchased and outfitted, along with the existing 27 acre land application area, with gravel underdrains and terraced to support the cascading overland flow system. This made this alternative more costly than the selected alternative.

6. **Mechanical biological treatment plant with wetland discharge.** This alternative, similar to Option 2, was considered because of the advantages associated with using a packaged mechanical biological treatment plant and lower capital costs due to avoiding existing lagoon modifications. However, approval from the EPA and the Tribe for the disposal method prevented this alternative from being selected in the ERWF. Please see Section 8 for a discussion on the effluent disposal methods.

7. **Eco-Machine biological treatment plant with discharge to Plummer Creek and land application.** This alternative was briefly considered, but due to the lack of working examples being cost-effectively operated, without a federal subsidy, it was considered to be too much of a risk for the City to select this type of treatment. Subsequently, cost estimates provided by the Eco-Machine design firm verified that it was a more expensive treatment method than the selected alternative, Option 2.

5.1 Design Considerations

Upon selection of the chosen treatment alternative, Option 2, USKH looked at two packaged treatment options. A packaged Kubota membrane bioreactor (MBR) treatment process and an AeroMod extended aeration activated sludge treatment process were considered for the primary biological treatment alternatives for the Plummer wastewater improvements. The treatment processes for both packaged plants utilize anoxic selection and alternating aerobic and anaerobic environments in order to facilitate removal of nitrogen and some phosphorus. Additionally both alternatives require an influent lift station, sludge dewatering equipment and storage facilities, additional phosphorus removal and effluent discharge with associated piping and appurtenances.

Also, it has been necessary to find a suitable site for the new facility. To that end, the City has negotiated with the State of Idaho and the Idaho Transportation Department for a property transfer. The site is currently being used as a borrow pit for ITD road improvements. Once the gravel removal operations are complete, expected to be in the fall of 2008, the property is to be transferred to the City of Plummer.

5.1.1 MBR Packaged Plant

The MBR system is a very effective combination of activated sludge treatment and membrane filtration processes and as a result, a high quality effluent is produced. These systems minimize reactor volumes and waste sludge handling requirements by operating with higher mixed liquor suspended solids concentrations and increased sludge ages. In order to meet effluent requirements set forth by Plummer's proposed 2010 NPDES permit (Table 4.2), the MBR plant would require several sequenced processes. These processes include: anoxic selection, pre-aeration, aerated bio-filtration through the membrane tubes, and sludge digestion and/or removal. See Exhibit 4 for a Process and Instrumentation Diagram.

Although the micro and ultrafiltration membranes used within an MBR are capable of removing viruses and bacteria, additional UV disinfection would still be required prior to release into Plummer Creek. A supplemental phosphorus removal system will be plumbed in, prior to disinfection, to facilitate phosphorus removal in the treated effluent to reach the 0.025 mg/L specified in the proposed 2010 NPDES permit.

A site visit to an operational MBR plant revealed that the MBR facility utilizes a complex network of piping and controls. Also, it was observed that the MBR's bi-stage solids extraction was configured so solids were removed at opposite ends of the plant. This creates challenges in site layout and design, operations and maintenance. The site visit also revealed that during maintenance to the membranes, the whole membrane bank must be pulled up or the membrane tank must be drained. It was also noted that when servicing the aerators located at the base of the membrane bank, the entire tank must be drained, which results in that area of the treatment being taken off line. Both of these maintenance scenarios add further challenges to the design of the MBR treatment plant and can impart significant disruptions to the treatment process. It should also be noted that the use of membranes within a wastewater plant can limit treatability in times of excess flow, which if not addressed in design, may potentially cause problems with effluent quality.

The MBR treatment plant is capable of future expansion, but extensive planning during the phase one design must ensure that piping systems and controls are extended and located at the perimeter of the phase one construction in order to ensure connection to the future phase facilities. These features are not inherent to the Kubota MBR design.

The City of Plummer currently employs a Class I operator and would need a Class II or possibly a Class III operator to be in charge of maintaining the plant and to follow the strict operation and maintenance requirements associated with a MBR. Failure to do so can result in extensive damage to the membranes, which could cause the treatment system to be taken off line during repair. Recent advances in MBR technology have refined the treatment process; however as a result there is not a sufficient amount of long-term operational data available. The availability of this data would allow common system malfunctions to be pinpointed over time and allow preventative measures to be created. Without it, the operator must be able to address and fix unforeseen problems within a timely fashion to minimize disruption to the City's wastewater treatment.

5.1.2 Extended Aeration Packaged Plant

The AeroMod packaged, extended aeration activated sludge treatment plant is relatively compact, and when the "Bio-P" configuration is used, it is a wastewater treatment plant generally used for biological nutrient removal. A major advantage of the extended aeration system is that the plant is able to operate efficiently over a range of inflows and organic loading. Additionally, the extended aeration plant is easy to operate. All control valves provided by the manufacturer are pneumatically driven and directly coupled with a compact push-button control panel. After a week of training, most operators are able to use the panel and simple testing procedures to efficiently control all the extended aeration functions of the plant.

The extended aeration treatment process employs the Bardenpho treatment method for nutrient removal and includes the following processes: anoxic selection, primary aeration, sequencing secondary aeration, clarification and aerobic digestion. See Exhibit 5 for a Process and Instrumentation Diagram. The reservoirs within the plant's aeration basins hold a layer of mature activated sludge that optimizes the ratio of mixed liquor suspended solids (MLSS) to biochemical oxygen demand (BOD_5). This ratio of MLSS: BOD_5 is roughly 20:25 and provides a sufficient amount of nutrients to the microbes within the basins to maintain optimum BOD_5 removal rates and to help nitrification, which lowers total nitrogen levels.

The extended aeration facility produces a low-phosphorus effluent. This biological phosphorus reduction is a result of promoting bacterial digestion of bio-available phosphorus coupled with the physical precipitation of particulates as a sludge component from aerated material. However, due to tightening phosphorus restrictions, additional phosphorus removal will be necessary following the effluent release from the clarification basin.

Following the extended aeration treatment process, disinfection will be necessary to meet the proposed 2010 NPDES permit criteria. A UV disinfection unit is necessary to treat the effluent and remove potentially harmful viruses and bacteria to within Class A reuse limits.

Expansion of the wastewater system's treatment capacity is relatively easily accomplished by placing another extended aeration treatment facility online to operate in parallel with the existing plant, thereby doubling the treatment capacity of the plant. Minimal planning needs to occur in the initial design when compared with what is necessary for MBR expansion.

Maintenance to the process parts of the extended aeration system is simply limited to extracting the hanging air diffusers from the edges of the treatment basins and repairing either by defouling or replacement. The blowers are the only moving parts of the system. The City must hire a Class II or possibly Class III operator to follow operation and maintenance procedures for the extended aeration plant and phosphorus removal system and to periodically sample the treated effluent.

5.1.3 Design Determination

Capital costs of the two treatment technologies were compared and the extended aeration treatment system prevailed as the lower cost alternative. Upon discussions with the MBR representative, a figure of $8-$9 per treated peak flow gallon was quoted. Given a peak flow of 0.630 mgd for the proposed plant's first phase, the cost of the treatment facility would be approximately $5.4 million. The extended aeration alternative with comparable levels of treatment and components has been priced at approximately $5 per treated peak flow gallon, or $3.0 million. These figures do not include the additional project costs of sludge removal, lagoon reclamation, an influent lift station, and rock-bed wetland discharge with associated appurtenances. In addition, the extended aeration process is a design that is easily operated, adaptable and capable of meeting projected flow increases and future changes in water quality criteria. With these considerations, the MBR-based treatment plant is too expensive and not adequately adaptable for the City of Plummer and the predicted growth. Therefore the extended aeration plant will be the preferred method for treatment.

Since the publication of the ERWF, the Idaho Department of Commerce has used the ERWF estimate for the preferred alternative as the basis for project funding using a Community Development Block Grant. The Rural Development agency (RD) of the United States Department of Agriculture (USDA) has also used the ERWF estimate for the preferred alternative to provide the basis for project funding.

6. Basic Design Data

There are eight components to the proposed treatment works. Each process (A-I below) has a redundant, parallel treatment in order to fulfill Class A reuse requirements. Additionally, the wastewater treatment plant will have emergency bypass piping routed from the influent screens to the effluent lift station, allowing any of the plant's processes to be avoided in the event of failure.

a. Lift Station
b. Headworks
c. Anoxic Selection
d. Primary and Secondary Aeration
e. Clarification
f. Aerobic Digestion

g. Additional Phosphorus Removal
h. Disinfection
i. Effluent Discharge

In addition, it is important to analyze:

j. Electrical Service and Power Distribution
k. Process Control, Data Acquisition and Monitoring Equipment
l. Odor and Noise Control
m. Sludge Handling and Disposal

a. Lift Station The system is sized within this document to take advantage of the entire hydraulic capacity of the plant under peak flow circumstances. The existing headworks, including the flow meter and comminuter, will be left running and in place until the new facility is operational. A new influent lift station is necessary for this project regardless of the treatment method chosen.

The influent lift station function is to lift wastewater from the collection system to the headworks of the new treatment facility. To best facilitate that function, the lift station is to be positioned at the end of the only common manhole in the existing collection system, located just outside and to the west of the existing wastewater treatment facility. Positioning the lift station at that point minimizes the lift to the new facility, requires the least amount of new piping, and is in an area already used for wastewater handling.

Design criteria for the lift station includes functioning through peak and minimum flows. Therefore pumps outfitted with variable frequency drives (VFDs) are desirable to reduce the size of the wetwell and deliver flows consistently to the treatment facility headworks. The range of flows coming into the plant, based on analysis of detailed flow meter data collected by the City since 2003, indicate that existing flows range from approximately 13 gallons per minute (gpm) to 328 gpm, corresponding to 0.019 to 0.473 million gallons per day (mgd) rates. For the first phase project, flows are projected to average 219 gpm (0.315 mgd), with peak daily flows of 437 gpm (0.630 mgd). Build-out flows are projected to average 417 gpm (0.6mgd), with peak flows of 833 gpm (1.2 mgd).

Solids handling pumps will handle solids and deliver them to the headworks static screen. Therefore, no screening will be necessary at the lift station itself. The influent station will be of the submersible pump type construction, with a wetwell located below the operating floor. Pumps will be accessible via a hatch. The power panel and control panel will be accessed from the operating floor. The preliminary selection is to use Goulds 4XD pumps or their functional equivalent for this application.

The wetwell will be constructed to counteract buoyancy resulting from local high groundwater, and will be constructed of concrete. The concrete will be treated with a sealant admixture or coated with interior and exterior water-tight seals.

The pumps will be in a duplex configuration, and will be VFDs as noted above. There will be one force main pipe exiting the lift station. The 6" diameter force main has been sized to optimize velocities in the range of flows expected between present day low flows of as little as 35 gallons per minute up to the build-out peak flow rate of 833 gallons per minute. This will be facilitated by a wet well sized to provide a minimum ten minutes of build-out peak storage. Level controls will be set to activate the lead pump only when at least ten minutes of minimum flow are stored, equivalent to 2,200 gallons.

b. Headworks Once lifted to the treatment plant, a 48" manually cleaned hydrosieve static screen will provide preliminary treatment of the raw wastewater. The static screen has no moving parts, requires no energy and is easy to install and operate. Daily maintenance is required to remove all collected solids and debris from the face of the screen. A bagging system will be used to easily collect and remove the screenings raked from the unit. Lime will be on hand to treat odor-causing organisms and compounds emanating from the bagged screenings and will be used as needed. Bagged solids will be stored in a covered storage area for further dewatering and drying before being placed in a dumpster for final disposal. A pickup schedule will be worked out with the City's waste management department in order to remove the bagged screenings from the premises. For redundancy, an additional screen will be included in the design, and room for a third screen will be provided to accommodate future build-out flows. Wastewater from the screens will be routed to the selector tanks in the AeroMod treatment unit.

c. Selector Tank The selector tank is a metabolic based selector that enhances sludge thickening and settling during the biological nutrient removal process by encouraging the growth of floc-forming bacteria and repressing filamentous bacteria growth.

The influent will pass through two tanks, a fermenter and an anaerobic tank plumbed in series, with a total capacity of 35,343 gal (17,671.5 gal) each with a minimum two-feet of freeboard. Each tank will be 14-feet deep, 18-feet wide and approximately 9.4-feet long. Under design flow conditions and accounting for return flows, the retention time (HRT) of the selector tanks is 1.3 hrs or 0.05 days. The fermenter encourages the production of volatile fatty acids that, when introduced into the anaerobic selector, react with the returned activated sludge releasing phosphorus that will feed organisms in the aeration basins.

To prevent transmission of odors, the selector tank and the aeration basins, clarification, and aerobic digestion processes described below will all be covered with a membrane or rigid cover that will provide prevention of aerosol-borne odors and ready access to equipment in any given basin.

d. Aeration Basins From the selector tanks, the flow will be routed to the two parallel primary aeration basins, each with a volume of 67,021 gallons, followed by two parallel sequencing secondary aeration basins, each with a volume of 66,883.5 gallons. Both primary and secondary aeration tanks must maintain two-feet of freeboard. The dimensions of the primary aeration basin will be 14-feet deep, 32-feet long and 20-feet wide. Secondary aeration basins are irregularly shaped, and will be 14-feet deep, a maximum of 42.63-feet long and 19.5-feet wide. The hydraulic retention time for the each aeration stage is 0.41 days (10.0 hrs), with a total HRT of .83 days (20.0 hrs) at average daily design flows.

The primary aeration basins will always maintain an aerobic environment, to encourage nitrification while the secondary aeration basins will alternate between anaerobic and aerobic environments in order to nitrify and de-nitrify the wastewater until the level of ammonia and nitrates are below the permitted discharge. This process will also remove a portion of the phosphorus reducing the concentration in the wastewater from 8 mg/L to $\leq$ 1 mg/L by converting it into biomass, which can then be removed via the waste activated sludge stream.

Coarse bubble diffusers will be placed in each basin for aeration. Using an inflow BOD concentration of 200 mg/l, it was calculated that 631 lb/day of oxygen is required for BOD reduction. It is assumed that total kjeldahl nitrogen (TKN) will have a maximum influent concentration of 25 mg/L, with a target effluent concentration of 1.5 mg/L, equal to 62 lb/day of TKN at the design flow rate. At an oxygen demand of 4.6 lbs per lb of TKN removed, 285 lb/day of oxygen is required to denitrify the TKN to 1.5 mg/L within the aeration basins. A residual oxygen level of 2 mg/l will be maintained in the basin at all times. The actual rate of oxygen transfer was calculated at 20 degrees C for analysis purposes. Therefore, the aeration basin will incorporate two (2) 25 horsepower blowers to meet the 33 hp of oxygen power needed (these aerators will also supply the air required for the digester and the clarifier). These calculations are included in the Appendix. USKH proposes to specify Kaeser Compressor Omega/Omega Plus rotary blowers or an engineer-approved equivalent.

e. Clarification From the secondary aeration tanks, the flow will be directed into two secondary clarifier tanks, each with a volume of 41,888 gallons with 2-feet of freeboard. The dimensions of the clarifiers are 14-feet deep, 20-feet long and 20-feet wide. The weir length for each clarification basin is 74-feet, resulting in a weir loading rate, at design flow, of 2,128 gpd/lf. The surface overflow rate, at design flow, for the clarifiers is 394 gpd/sf. At design flow, the HRT within the clarification vessels is 0.27 days (6.4 hrs).

Secondary clarification is an imperative step in the suspended growth biological/activated sludge treatment process. The purpose of clarification at this stage is to separate the MLSS from the treated wastewater prior to tertiary treatment, disinfection and discharge. Approximately 2 hp of oxygen power will be used within the clarification basins to facilitate the settleablity of suspended solids. The solids loading rate, calculated at design flow, is 19.8 lbs/day/sf. Internal pumps will recycle return activated sludge from the secondary clarifier to the anoxic tank. The RAS flow in the AeroMod will be approximately 100% of the flow of the plant. Waste sludge will also be drawn from the RAS flow at a flow of approximately 15,500 gal/ day and directed to the aerobic digester. See the Appendix for calculations.

f. Aerobic Digestion Extended aeration wastewater plants typically minimize waste activated sludge production by providing a large endogenous decay of sludge mass.

Waste activated sludge is routed from both the secondary aeration tanks and from the clarifiers to the aerobic digesters. These digesters have 1.5-feet of freeboard and are 14.5-feet deep, 40.75-feet wide and 8-feet long. The volume of each digester is 35,358 gallons. The solids retention time in the digester is calculated to be 30 days, which results in a 17.6 % reduction of volatile solids at 20°C. Oxygen requirements to reduce the volatile suspended solids within the digesters are approximately 593 lb/day, which results in an air requirement of 204 cu ft air/min. In the case of only operating one digester, the oxygen required for VSS reduction is 297 lb/d and the necessary air required is 102 cu ft air/min. Estimated total horsepower requirement for the aerobic digesters is 9 hp for both tanks, or 4.5 hp for a single tank.

Waste flow from the aeration basins to the aerobic digester is approximately 12,000 gal/day. The digester receives approximately 15,500 gal/day of waste flow from the secondary clarifiers. During operation at design flow, daily waste generation from the aerobic digester is expected to be approximately 2,578 gallons. This waste flow will contain a 1.2% sludge concentration, resulting in 258 lb of solids per day to be dewatered and disposed. Full build out will increase the volume of sludge generated to 5,156 gallons per day, which results in a solids production of 516 lbs/day.

g. Additional Phosphorus Removal. The proposed 2010 NPDES permit for the city of Plummer requires a phosphorus level of less than or equal to 0.025 mg/L on an average monthly basis. The extended aeration treatment plant is capable of meeting a low phosphorus limit, approximately 1.0 mg/L. However, an additional treatment process capable of phosphorus reduction will need to be added prior to disinfection during the first phase of construction in order to meet the anticipated effluent water quality standards. The resulting treated effluent will meet Class "A" effluent specifications; as defined in IDAPA 58.01.17. Further, the chosen phosphorus removal system has been accepted and certified by the State of California Department of Health Services as meeting the Title 22 water recycling criteria. Additionally, this process has been approved by the Idaho Department of Environmental Quality provided the influent to the filter is coagulated, has a turbidity of less than 10 NTU and that the loading rates do not exceed 5 gal/ft^2/min and is followed by a disinfection process that achieves the parameters set forth in Section 600.07a of IDAPA 58.01.17 . Copies of each of these certifications are included in Appendix IX.

The ion-exchange upflow clarifier process has been selected for the tertiary treatment for additional phosphorus removal. Utilizing "reactive filtration", the filter media is constantly scoured and regenerated during operation, resulting in a continuously clean, reactive surface area that effectively filters the effluent without interruption, eliminating the need for backwash or media recharge.

An array of four filter beds will be used, in a dual pass configuration to reach the 0.025 mg/L permit limit and provide the redundancy required for Class A reuse status. A solution containing iron is added to the effluent stream prior to a contact zone where the mixture will be conditioned in order to optimize both adsorption and co-precipitation. From the contact basin, the mixture penetrates the moving sand filter through distribution arms located beneath the sand bed. The flow is driven upward, through the filter media and clean water is discharged from the top of the filtration unit. Within the filter, the sand settles to the bottom and is then returned, by air lift, to the top of the unit where a washbox separates the waste from the filtration media. From the washbox the clean media descends to the top of the bed and the waste, consisting of iron, phosphorus and other contaminants is diverted to the reject piping. Reject and the tank drains will be routed to the plant's waste stream which will ultimately be fed back into the treatment plant headworks via the sewer collection system.

h. Disinfection Prior to effluent disposal, the treated wastewater must be disinfected in order to remove any harmful pathogens. UV disinfection is a process in which ultraviolet rays are used to destroy bacteria and viruses by photochemically altering an organism's DNA, thereby preventing reproduction and as a result, infection.

From the tertiary phosphorus removal, the wastewater, with a temperature range of 33-85 degrees Fahrenheit, a maximum TSS concentration of 5 mg/L, and a minimum UV transmittance of 65%, will be routed through a stainless steel channel UV disinfection chamber, utilizing low-pressure, low intensity lamps housed in quartz sleeves. The lamp life for each UV bulb is expected to be approximately 12,000 hours. Dimensions of the UV channel are 23.17-feet long, 2.0-feet deep, and 2.67-feet wide.

The preliminary disinfection system chosen will be a low pressure, low intensity, Trojan 3800K-PTP 2 channel UV Disinfection System, or approved equivalent. Due to the disposal method chosen, Class A effluent is required. Therefore the disinfection system must reach a kill of 2.2#/100mL as stated in Table 4-2. The 3800K-PTP disinfection system has two banks of UV bulbs (20 lamps per bank) in each channel, and when two channels are run in series, the previously mentioned kill is achieved.

Due to unforeseen maintenance issues and potential problems, an additional UV disinfection channel is required for system redundancy to ensure effluent disinfection requirements are continuously met. Therefore, a third UV channel will be plumbed, in series, into the disinfection UV/pipe train. This UV channel can be brought on line at any time when one of the two primary UV channels is being serviced; ensuring the necessary kill is reached.

As previously mentioned, during Phase I, three UV channels will be installed (two duty units, one redundant unit). Manually-set gate valving and parallel header pipes will be used to maintain two UV banks in operation at a time. Phase I will require no flow splitting since the effluent will flow through two UV channels in series. Phase II will require the addition of two more UV channels. At this time, the existing valves will be used to split flow between the first set of UV banks. The original configuration of the UV banks will remain, with the effluent flowing through the two existing UV banks in series; the difference in the Phase II set up is that the new UV channels will also be plumbed in series, but will also be in parallel with the existing UV channels. This set up will allow the UV disinfection system to accommodate Phase II peak flows of 1.2 MGD, and still maintain Class A redundancy.

When accounting for the 80% sleeve fouling factor, the Trojan PTP delivers a dosage of 110,092 $\mu Ws/cm^2$ to achieve the 2.2 organisms per 100 mL standard. In order achieve this dosage, flow through the UV channels is controlled by two transition boxes located at the inlet and outlet of the UV channel. These transition boxes create a plug flow condition through the UV channel, thereby enhancing disinfection efficiency. It is expected that there will be 1.16 feet of head loss from the inlet of the first UV channel in series to the outlet of the second channel. To accomodate these losses, the UV channels will be positioned on top of concrete risers of varying height to ensure the system will function properly during Phase I and in Phase II when additional UV channels are added to the disinfection system's configuration.

It is imperative that the lamp sheaths are kept clean in order to achieve the desired disinfection level. A maintenance rack shall be provided with the Trojan PTP UV system. This rack can hold one module of four UV lamps to easily allow the operator to clean the lamps with food grade citric acid. The citric acid solution is also suggested to clean the stainless steel UV channel before and after the UV lamps. In order to service the UV channel, the isolation valves located on both the upstream and downstream ends of the UV channel must be closed and, if needed, the 2-inch drain located in the stainless steel channel can be opened to drain the channel contents, creating a dry work zone. It is also recommended that four additional lamps, sleeves and lamp holders are kept onsite in order to facilitate timely maintenance.

The Trojan 3800K-PTP UV disinfection system is equipped with a submersible sensor which monitors the lamp hours and intensity of the UV banks contained within each channel. The system monitor has an elapsed time display that provides a continuous readout of each lamp banks operational hours. There is also a dry contact within the system monitor that will sound an alarm in the event the UV intensity falls below operational settings.

No special HVAC system requirements are necessary with the Trojan PTP UV disinfection system because the units use convection cooling to dissipate the heat of the lamp ballasts into the air which eliminates the need for air conditioning or forced air cooling. Proper ventilation of the UV room within the Mechanical building will be sufficient; the air exchange rate will be 10 volumes per hour.

*i. **Effluent Discharge*** The effluent lift station will be pumping essentially clean water exiting the last treatment process – UV disinfection - up to the discharge site. The discharge will be through an artificial emergent wetland. The wetland will be saturated below the surface by effluent pushed out from a perforated header pipe at low pressure, with squirt height reaching a maximum of approximately 5 feet at peak flows.

The effluent lift station will be positioned lower than and to the south of the UV disinfection room. Flow from the UV disinfection troughs will feed into a manifold, rather than a wetwell, from which the effluent booster pumps will draw. The booster pumps will then feed into the effluent force main piping. As with the influent lift station, the effluent lift station will have VFD pumps. Like the influent force main, the effluent force main piping will also utilize a single 6-inch discharge pipe. As the pipe will be carrying Class A reuse water, it will be purple pipe conforming to the requirements of IDAPA 58.01.17 in all respects. This pipe will be routed to discharge to the perforated header pipe in the artificial emergent wetland.

The design flows for the effluent lift station will be identical to those in the influent lift station.

The pumps will be in a conventional wet well lift station configuration. They will be immersed in a wet well, and controlled from panels located under a shelter on top of the lift station wet well, with the line from the UV disinfection discharging to the wet well. The pumps will be accessible and maintainable by rails and pull chains. The preliminary pump selection for the effluent lift station pumps is the American Marsh 8KC 3 stage pump or its approved functional equivalent.

The pumps will be in a triplex configuration, and will be VFDs as noted above. The 6" diameter force main existing the effluent lift station has been sized to optimize velocities in the range of flows expected between present day low flows of as little as 35 gallons per minute up to the build-out peak flow rate of 833 gallons per minute. Varying flows be facilitated by using the VFD pumps. A minimum velocity of only 0.4 feet per second will occur during minimum evening flows, with peak build out velocities as high as 9.5 feet per second.

j. Electrical Service and Power Distribution The electricity for the treatment facility will be fed by the City of Plummer. Incoming service will be provided by extending three phase power aerially across the previously mention Trail of the Coeur d'Alene's to a new utility pole and corresponding (480/277Y secondary) pad mount transformer. The utility transformer will feed a new 600A, 480V service.

The electrical service for the treatment plant will be designed for a maximum load of 400kVA. The projected running load for the plant is expected to be approximately 275kVA. A diesel driven stand-by generator will be provided, on site, as a back up power source serving all process equipment and both the influent and effluent lift stations in case of a temporary power failure. The generator's anticipated size is 400kW to allow for motor start-up. A single automatic power transfer switch will be located adjacent to the main distribution panel in the operation building's blower room. This main distribution panel will distribute 480 volt, three-phase power to the process areas via underground power duct banks. There will be step-down transformers and 120/240 volt panel boards located throughout the plant to provide service for lighting, receptacle, and other incidental loads.

k. Process Control, Data Acquisition and Monitoring Equipment The new facility will have a process logic controller (PLC) that will monitor status and alarm conditions of all process equipment, including the extended aeration treatment unit. The PLC will be connected to the influent flow meter and detected flow will automatically adjust motor-controlled plug valves to divert into one or both of the two treatment trains in the plant. The PLC will control the operation of the plug valves at the effluent end of the headworks. Other than influent flow control, the PLC will also provide signals to the influent and effluent lift stations to provide control of the automatic valves directing flow to one or more force mains at each lift station. The PLC will have an operator interface for setpoint adjustments, viewing plant status including various flows, equipment run status and alarm histories. The Operator interface will be a PC based system located in the office of the maintenance building.

Process control for the extended aeration portion of the plant will be from the manufacturer's flow-paced pneumatic control system, and will also be monitored from the maintenance building's office.

In addition, the plant will be equipped with an automatic alarm autodialer to notify plant personnel of conditions that may require attention. The auto dialer will receive alarms from the PLC, various individual hardwired alarm points, and the fire alarm control panel.

The plant will be designed to meet the requirements of the National Fire Protection Agency (NFPA)-820 "Fire Protection in Wastewater Treatment Facilities". This includes the installation of combustible gas detectors in the headworks and other enclosed structures where buildup of gas could become a potential problem. Also, the detection of a lower explosive limit (LEL) will initiate an alarm and will activate the appropriate ventilation system. The NFPA-820 also requires the laboratory, office and dewatering areas of the plant to be equipped with a fire alarm control panel (FACP), installed per NFPA 72. This FACP will interface with the plant's emergency autodialer system to notify the appropriate personnel in the event of a triggered alarm.

Furthermore, telephone service will be provided in the office and laboratory and as specified in other areas of the plant. The telephone service available at the entrance of the treatment plant site will be extended to the facility. All communication signals will be delivered around the plant via underground signal ductbanks.

Lastly, site lighting will be designed to enhance plant security, ensure Operator safety and comfort, reduce vandalism, and mitigate light trespass onto adjoining property.

l. Odor and Noise Control. The Trail of the Coeur d'Alenes bike path passes within 30 feet of the southern edge of the treatment plant. To keep noise to a minimum along the path, the blowers will be kept as far as possible from the trail and will be equipped with mufflers. Other noises generated within the treatment plant are considered to be minimal.

Odor is not considered to be a large problem with extended aeration plants. A hopper of quick lime will be kept in the mechanical building in order to, when necessary, mask the odor of the raw, bagged primary screenings. The sludge processing area is not expected to emit unpleasant odors.

m. Sludge Handling and Disposal Sludge will be removed from the aerobic digesters by a progressive cavity sludge pump, included in the AeroMod package. From the digesters, the sludge will enter a 1.2 m Tritan belt filter press capable of dewatering 450 lb/hr, producing a Class "B" sludge with approximately 18-22% solids concentration. This belt press also includes a rotary drum thickener, which will pre-thicken the sludge prior to dewatering, reducing the amount of additional polymer needed to maintain a cake-like consistency. Polymer requirements for sludge conditioning are not expected to exceed 17 lbs/2000 lbs dry sludge. At full capacity, the volume of de-watered sludge will not exceed 52 cubic feet per day.

The Tritan belt filter press will continually use 28 gpm of wash water during operation. At the end of every dewatering cycle, an additional high-pressure wash sequence using 10 gpm for 10 minutes will be needed. The wash water for the belt filter press will be supplied from a 5,000-gallon treated effluent storage tank, located onsite. A Franklin 4" High Capacity submersible pump or approved equivalent, capable of pumping 40 gpm at 50 psi when coupled with a controller to maintain constant pressure while washing, will be placed into the effluent reservoir and will supply the sludge room with the required flow. An inline basket filter will be added to the wash lines, to ensure the wash nozzles on the belt press do not clog from the non-potable water. The effluent storage facility must be identified by a sign, per IDAPA 58.01.17, that states "Reclaimed Wastewater: Do Not Drink".

Upon dewatering, the sludge will be conveyed via screw auger with a flexible polyethylene (PE) pipe end attachment into a 25-foot by 25-foot covered storage area adjacent to the sludge handling room. An additional 30-foot by 30-foot storage area will be available for use when there is a lag in sludge disposal. Both of these sludge storage areas will be equipped with floor drains that lead to the treatment plant's waste line that gravity feeds to existing sewer. The fate of the sludge is further discussed in Section 9 of this report.

7. Industrial Waste

The City of Plummer does not have an industrial waste discharger at this time. In the event an industrial discharger does locate in Plummer, a pretreatment program will be developed by the City to treat the wastes from such a discharge to a level acceptable for the continued operation of the new municipal treatment facility that is the subject of this predesign report. However, the City will develop an industrial pretreatment ordinance to prepare for a pretreatment program should one become necessary.

8. Wastewater Disposal Method Analysis

Based on the hydrogeologic study that was conducted by Wyatt Engineering (USKH) in August of 2002 and included in Appendix III of the ERWF, the depth to groundwater is estimated to be approximately 20-30 feet below the existing land application area, although it could be as shallow as 10 feet. Groundwater in the area is expected to flow toward the southeast, toward Lake Chatcolet, which is hydraulically upgradient of and surficially connected to Lake Coeur d'Alene.

As discussed in the ERWF, the engineer who conducted the 2005 geotechnical investigation for this project indicated that a shallow perched water table condition is likely to develop under natural conditions in the soils beneath the land application site. From this information, it is deduced that a drainfield or wetland effluent infiltrating to the silt layer would most likely flow across the shallowest clay lense. Flow moving across this clay lense would eventually discharge through soil pores to a possible unconfined shallow perched aquifer above the primary drinking water source aquifer for the City of Plummer. Therefore, the treated effluent quality must meet groundwater discharge quality guidelines set forth by the State of Idaho and the Coeur d'Alene Tribe.

Prior to the ERWF publication, the existing treatment lagoons owned by the City were evaluated for effluent disposal and only the primary lagoon would be considered for a disposal system design. The existing primary lagoon has a surface area of approximately 2.95 acres. This acreage has been shown not to be adequate to evaporate and infiltrate future design flows from the facility. As a result, the ERWF selected disposal alternative is here reevaluated along with the wetland disposal alternative, to determine the best disposal method for the City of Plummer. The two alternatives are as follows:

a. *Discharge to Plummer Creek and land application.* This method was selected as the preferred disposal method in the ERWF. As mentioned previously in this report, in order to accommodate the necessary storage volume of 20 million gallons for the treated effluent from the treatment plant, the primary lagoon would need to be dredged, re-graded and fitted with an impermeable geo-membrane liner.

   The 20 million gallons of storage would be used to store a month's worth of treated effluent produced by the treatment plant at full build-out, average daily flow of 600,000 gallons per day. This storage volume would act as a buffer during the periods between allowable land application and allowable discharge to Plummer Creek each May and October. During the months October through May, the treated effluent would be discharged from the plant to the lined storage lagoon in order to be discharged into Plummer Creek at a controlled rate from November through April. An in-stream flow meter would be used to monitor the rate of release, ensuring that no more than 10 percent of the stream flow would be released at any given time.

   During the growing season, May through October, the treated effluent would be used in land application to irrigate alfalfa fields owned by the City. Additional land, approximately 40 acres, would need to be acquired by the City, in addition to the 10 acres currently owned, in order to utilize the entire volume of effluent produced by the treatment plant. Eventually, once the new land application area becomes permitted, the existing 530-660 gpm irrigation pumps would need to be overhauled or replaced. Additionally, the solid set sprinkler irrigation system would be re-evaluated and new irrigation alternatives would be examined.

b. *Discharge to an upland wetland for subsurface disposal.* This disposal alternative was mentioned in Option 6 in the ERWF. Instead of land application during the summer and creek discharge in the winter, a year-round discharge to a polishing wetland located in proximity to the upper Plummer Creek area will be possible. Although direct disposal to Plummer Creek is avoided with this alternative, this subsurface disposal would require Class "A" effluent as the effluent will diffuse overtime into the Creek. In order to meet the associated effluent limit requirements, the upflow clarifiers capable of additional nutrient removal would be built with phase one construction, rather than phase two as stated in the ERWF. The storage lagoon and existing land application area would no longer be needed. Additionally, no new land application area would need to be acquired and subsequently improved. Upon approval of this disposal alternative, the Coeur d'Alene tribe and the EPA would consult to prepare the City's 2010 NPDES permit accordingly.

Disposal alternative A was explored in depth with the ERWF and was selected as the preferred alternative. However, since the publication of the ERWF, alternative B was increasingly considered to be the more viable option. Conditional approval from the EPA was obtained in April of 2008 for the wetland disposal method. The condition is acceptance by the Coeur d'Alene Tribe, which occurred by Tribal Council decision on June 10, 2008. Alternative B will eliminate the need for the expanded storage lagoon. Upon considering the costs for each disposal alternative, the discharge to the upland wetland proved to be the least expensive alternative. The existing lagoons will be dredged and filled in and other treatment facilities will be demolished. The land on which they reside will be reclaimed by the City of Plummer.

Further study undertaken as part of the design process confirms that groundwater levels in the vicinity of the proposed discharge wetland area is greater than 12 feet, based on test pit logs (GeoEngineers, July 21, 2008). It is presumed that unconfined groundwater exists below that elevation.

The condition of approval for the discharge wetland from the Coeur d'Alene Tribal Council included specific design criteria. These criteria include:

> The wetland has to have a higher infiltration rate than the soil that it is constructed on. That way, the effluent from the treatment plant will be forced through cleansing layers to remove suspended solids and nutrients. The wetland grasses will uptake the nutrients through their roots so the oxygen levels in the water remains relatively constant. However, diurnal flow fluctuations and plant respiration cycles will cause some variation in dissolved oxygen levels reaching Plummer Creek.
>
> The wetland size was determined by the amount of flow that will be discharged from the

plant. The perforated pipe that will drain into the constructed wetland will have 1/4-inch holes every foot along the 260-foot length. The length and size of the holes were calculated using the peak discharge from the treatment facility. The perforated pipe will equally discharge the flow throughout the entire wetland.

The proposed wetland filter discharge will not be constructed in an existing wetland. The proposed wetland will be a man-made wetland located at least 25-feet away from the stream bank. There will be no direct pipe discharge to Plummer Creek.

The flow in Plummer Creek will not be made up of the treatment facility discharge. The purpose of the discharge wetland is for treated wastewater to filter through natural soil and rock filters before eventually making its way to the Creek bank.

The proposed wetland will be constructed outside of the 100-year floodway, but portions of it will be within the 100-year floodplain.

Additional design criteria include protecting groundwater below the discharge area. To accomplish that, the existing clay layer on the site will be amended with bentonite or other sealing clay to decrease the permeability underlying the discharge beds to 1×10^{-6} cm/second or less through a section at least 6-inches thick.

The components of the system operating together, including the additional phosphorus removal, will produce an effluent that meets the limitations set forth in Table 4-2. The effluent limits in Table 4-2 must be met in order to employ the chosen effluent disposal method.

9. Sludge Disposal

New Facility. The following biosolids application plan, prepared in accordance with IDAPA 58.01.16.650, address sludge management once the biosolids are removed from the Aeromod's aerobic digesters.

Upon removal from the digesters and additional dewatering from the belt filter press, the sludge will consist of approximately 16% to 20% solids and will have been significantly reduced in volume. From the belt filter press the sludge will be placed, as previously mentioned, in two storage areas, one being adjacent to the belt filter press room in the Mechanical Building. An overflow storage area will be available in times of excess sludge production, or in case disposal methods become temporarily unavailable.

From the storage beds the sludge will be trucked to agricultural fields and spread on the topsoil with a conventional manure spreader. An agronomist was hired to perform a land application analysis. The agronomist has assessed the City's existing summer land application field for suitability for long-term biosolids application, based on the analysis of the existing lagoon biosolids. His analysis concludes that there is sufficient capacity for long term application of biosolids.

Soils at the site are characterized as silt loam from zero to a depth of 24-inches, overlying a silty clay loam extending to depths of 60-inches or more. The entire field is on a generally south-facing slope varying from 5-percent to over 20-percent in steepness. The drainage pattern within the field is toward a central swale angled north-south for most of its length, but veering to the southwest toward the southern end and discharging toward Toetly Road.

Surrounding land uses include agricultural fields to the west and north, fallow field to the east, and forested land to the south. The site is bounded on the west and north by gravel roads. The site was described geologically in the ERWF, Appendix III. Below the clay layer, bedrock in the lower part of the site is Wanapum basalt. Higher, toward the hill defining the north extent of the Plummer Creek basin, bedrock is described as the upper member of the Wallace Formation of the Pre-Cambrian Belt Supergroup, a granitic formation.

Climate in Plummer is temperate, with a somewhat higher level of annual precipitation than areas within 50 miles to the north and west, at approximately 26 inches of average annual rainfall per year. Average annual temperatures range from average highs in the low 80 degrees Fahrenheit during July, to the mid 20 degrees Fahrenheit during January.

There is enough area to allow the application location to rotate, ensuring the sludge does not build up in one area over time and increase contaminants in the soil above EPA limits. Plant-available nitrogen calculations show that the existing field planting of alfalfa and orchard grass, yielding approximately 3 tons per acre, uptakes approximately 124 pounds of nitrogen per acre. This is equivalent to 37 dry tons of total solids per acre, making the area more than adequate to uptake the estimated annual loading of 57 dry tons of solids removed per year.

There have been a few studies conducted that have explored the link between land application of biosolids and adverse health effects. Primarily, reports of e.coli, other bacterial infections and respiratory complications make up the majority of the reported health effects. In order to avoid subjecting the citizens of Plummer to these complications, the City will take several steps. First, the biosolids will be processed to 40 CFR Part 503 standards, including reduction of volatile solids by at least 38 percent, dewatering, and possibly disinfection using lime or some other amendment prior to discharge from the belt-filter press room. Biosolids discharged from the belt-filter press room will be stockpiled in a trailer and transported approximately 2,000 feet to the stockpile area shown on Exhibit 6, Biosolids Land Application Site. Biosolids will be tested for coliform prior to transfer to the land application site. Biosolids will be integrated into the soil within 48 hours of surface application. This will most likely be done using a spreader dump followed by a tractor-pulled disc harrow. Additionally, signs will be posted on the fenced application areas stating that biosolids are stored and have been applied. Access to the application area is to be restricted for 30 days following any biosolids application.

Frequent monitoring of the land application area will be required as part of a biosolids application permit. Prior to application, biosolids will be sampled for all 40 CFR Part 503 metals and nutrients. This assay will be compared to the projected concentrations, and the application rate will be adjusted proportionate to the limiting parameter to assure that over-application does not occur.

In accordance with 40 CFR Part 503, the sludge will meet Class B biosolids standards. In May of 2008 samples were collected from the existing wastewater lagoons to test concentrations of pollutants listed in the CFR. The results of the testing are below, along with the pollutant ceiling concentrations allowed for land application.

Table 9-1
40 CFR Part 503 Land Application Pollutant Limits

Pollutant	Ceiling Concentration Limits For All Biosolids Applied to Land, mg/kg	Sampled Sludge concentrations, mg/kg	Existing Lagoon Estimated application concentration, mg/kg	Projected Annual Estimated application concentration, mg/kg	No. of years capacity at projected annual appl. Conc.
Arsenic	75	0.03	0.003	0.0002	>100
Cadmium	85	ND*	ND	ND	>100
Chromium	3,000	0.39	63.8	4.91	>100
Copper	4,300	4.17	598.5	46.0	80
Lead	840	0.96	165.2	12.7	53
Mercury	57	0.02	0.001	0.0001	>100
Molybdenum	75	ND*	ND	ND	>100
Nickel	420	0.29	45.8	3.53	>100
Selenium	100	ND*	ND	ND	>100
Zinc	7,500	11.77	0.86	0.07	>100

*No Detection

Existing Facility. There are three disposal alternatives under consideration for the biosolids to be removed from the existing lagoons. Based on sampling conducted and analyzed in May 2008, the biosolids will meet Class B standards as defined in 40 CFR Part 503. From the lagoon sampling, the quantity of biosolids to be removed from the existing lagoons is estimated to be 185 dry tons.

The first alternative is to land apply the biosolids on the City's current land application area. The biosolids would be applied at agronomic rates, with lead or nitrogen as the limiting parameter. A biosolids application plan would be prepared in accordance with IDAPA 58.01.16.650 and 40 CFR Part 503.

The second biosolids alternative is to send the material to Eko Compost's Lewiston facility.

The third biosolids alternative is to stabilize it in place and use it as a soil amendment. Because of the very low concentrations of contaminants and the relative concentration of the biosolids compared to the total projected fill volume, IDEQ has determined that the facility would not have to be classified as a landfill. This

10. Provisions for Future Needs.

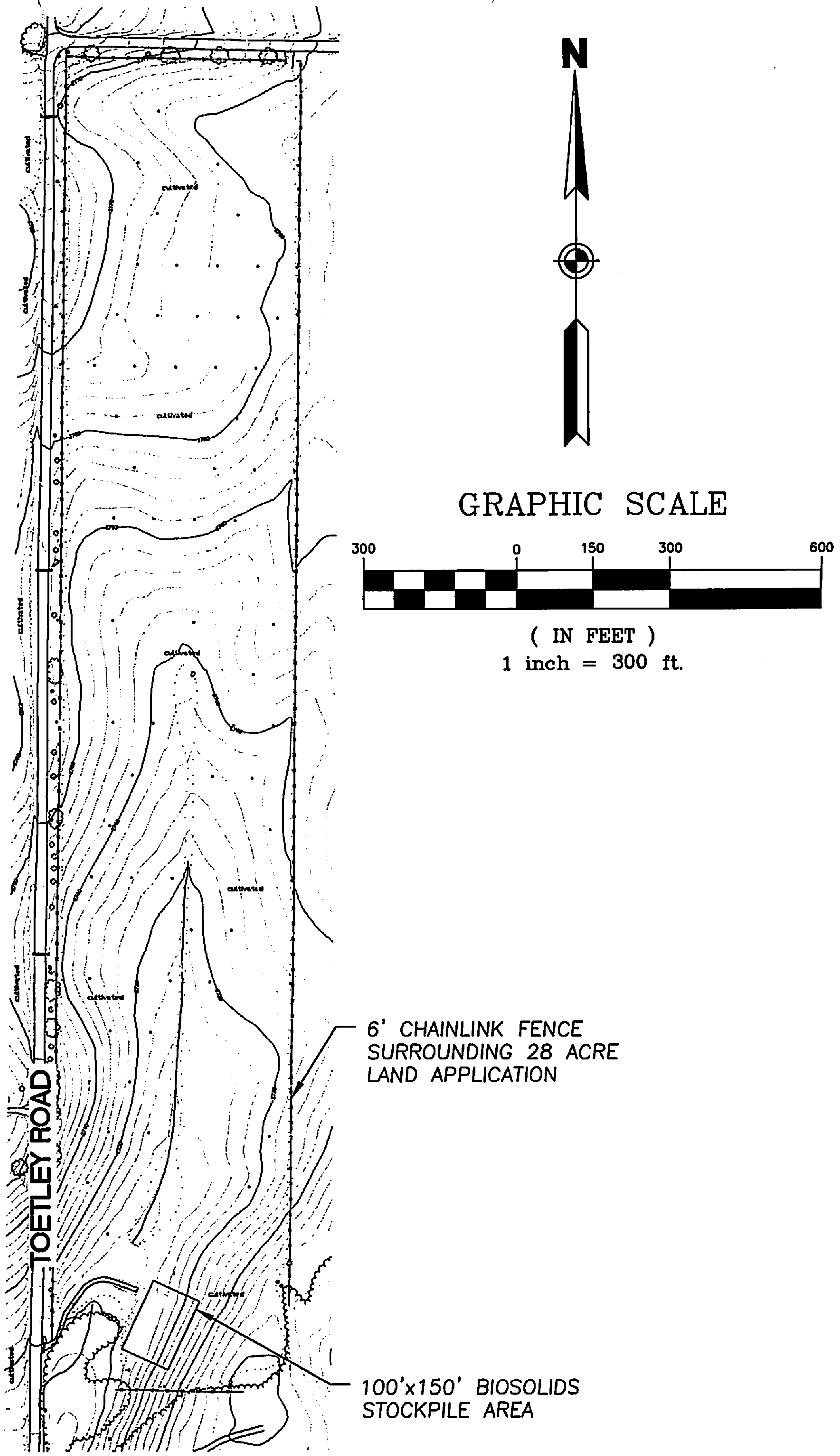
The new wastewater treatment facility has been designed for flows projected through 2026 by extrapolating a growth rate of 2.2% as discussed in the ERWF. The upland wetland effluent disposal area is expected to support the increase in flows through full build out of the treatment plant. Beyond that time, additional treatment and effluent disposal methods will need to be explored.

11. Staffing and Testing Requirements

A Class III operator will most likely be required to operate and maintain the new wastewater treatment facility for the City of Plummer, pending final determination by IDEQ. The City will be required to support the primary operator with a backup operator of the same of higher classification. The primary operator will need to be available as described in the operations and Maintenance manual. Over the long-term operation of the plant, this person should be able to maintain efficient operation of the system on about 20-25 hours per week.

12. Cost Estimate

A revised life-cycle cost estimate is included in the Appendix. This revised estimate shows that a Phase I project construction budget of $7,076,506 should be adequate, as will operating costs of $211,320 per year. Total project cost, including engineering construction and a 15% contingency is $13,590,114. Using an annual inflation rate of 4%, the present value of 20 years of operation at $211,320 per year is $2.59 million.



USKH Engineering • Land Surveying Planning • Architectural	Project PLUMMER WASTEWATER TREATMENT PLANT PLUMMER, IDAHO Client City of Plummer, Idaho	Date 9-30-08 Drawn ALB Checked AEG	Sheet EX6